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1.2. Safety Note

1

The voltage of the frequency converter is dangerous whenever connected to mains. Incorrect installation of the motor, frequency converter or fieldbus may cause damage to the equipment, serious personal injury or death. Consequently, the instructions in this manual, as well as national and local rules and safety regulations, must be complied with.

1.2.1. Safety Regulations

1. The frequency converter must be disconnected from mains if repair work is to be carried out. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.
2. The [OFF] key on the control panel of the frequency converter does not disconnect the equipment from mains and is thus not to be used as a safety switch. 3. Correct protective earthing of the equipment must be established, the user must be protected against supply voltage, and the motor must be protected against overload in accordance with applicable national and local regulations.
3. Correct protective earthing of the equipment must be established, the user must be protected against supply voltage, and the motor must be protected against overload in accordance with applicable national and local regulations.
4. The earth leakage currents are higher than 3.5 mA.
5. Protection against motor overload is not included in the factory setting. If this function is desired, set par. 1-90 Motor *Thermal Protection* to data value *ETR trip* or data value *ETR warning*. Note: The function is initialised at 1.16 x rated motor current and rated motor frequency. For the North American market: The ETR functions provide class 20 motor overload protection in accordance with NEC.
6. Do not remove the plugs for the motor and mains supply while the frequency converter is connected to mains. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.
7. Please note that the frequency converter has more voltage inputs than L1, L2 and L3, when load sharing (linking of DC intermediate circuit) and external 24 V DC have been installed. Check that all voltage inputs have been disconnected and that the necessary time has passed before commencing repair work.

1.2.2. Warning Against Unintended Start

1. The motor can be brought to a stop by means of digital commands, bus commands, references or a local stop, while the frequency converter is connected to mains. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient.
2. While parameters are being changed, the motor may start. Consequently, the stop key [STOP/RESET] must always be activated; following which data can be modified.
3. A motor that has been stopped may start if faults occur in the electronics of the frequency converter, or if a temporary overload or a fault in the supply mains or the motor connection ceases.

1.2.3. Warning

Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains.

Also make sure that other voltage inputs have been disconnected, such as external 24 V DC, load sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic back up.

Please refer to the relevant Operating Instructions for further safety guidelines.

2. Introduction

2.1.1. About this Manual

First time users can obtain the most essential information for quick installation and set-up in these chapters:

Introduction

How to Install

How to Configure the System

For more detailed information including the full range of set-up options and diagnosis tools please refer to the chapters:

How to Control the FC 300

How to Access FC 300 Parameters

Parameters

Troubleshooting

2.2.1. Technical Overview

The Interbus system is divided into two different systems: remote and local.
The remote system enables the user to connect up to 256 stations on a single system with a maximum of 400m cable length between stations.
The local bus system enables the user to establish communication to Input/Output devices through a single twisted pair of Cables. This type of communication typical uses simple devices, e.g. Digital I/O devices.

The Interbus option described in this manual supports remote bus only. For communication on the remote bus, the Interbus system provides two different types of communication: Process Data and PCP (Peripherals Communication Protocol). The Process Data is cyclic communication to devices with high priority.
Examples of this type of communication are digital and analogue I/O or control word and reference to frequency converters.
PCP communication is used for communications which do not require high speed and typically only are activated on request from the user-written program. Typical time to read/write a single value is 100 to 200 milliseconds. Examples of this type of communication are configuration data, or reading of service parameters such as running hours, numbers of power ups and kWh.

2.3.1. Assumptions

This manual assumes that you are using a Danfoss Interbus Option in conjunction with a Danfoss FC 300 Automation Drive. It is also assumed that your master is a PLC or PC that is equipped with a serial communication card supporting all the Interbus communication services required by your application, and that all requirements stipulated in the Interbus standard as well as those set up in the Drivecom frequency converter Profile and its company-specific implementation, as well as those pertaining to the VLT frequency converter are strictly observed as well as all limitations therein fully respected.

2.4.1. Hardware

This manual relates to the Interbus option type no. 130B1211.

2.5.1. Background Knowledge

The Danfoss Interbus Option is designed to communicate with any master abiding by the Interbus standard. It is therefore assumed that you have full knowledge of the PC or PLC you intend to use as a master in your system. Any questions pertaining to hardware or software produced by any other manufacturer are beyond the scope of this manual and are of no concern to Danfoss.
If you have questions about how to set up master-to-master communication or communication to a non-Danfoss slave, please consult the appropriate manuals.

The following literature is available for the , 200 and series.

Title	Literature no.
Operating Instructions	MG.11.AX.YY
Design Guide	MG.11.BX.YY
Programming Guide	MG.11.CX.YY
VLT AQUA Drive FC 200 Operating Instructions	MG.20.NX.YY
VLT AQUA Drive FC 200 Design Guide	MG.20.MX.YY
VLT AQUA Drive FC 200 Programming Guide	MG.20.OX.YY
VLT AutomationDrive FC 300 Operating Instructions	MG.33.AX.YY
VLT AutomationDrive FC 300 Design Guide	MG.33.BX.YY
VLT AutomationDrive FC 300 Programming Guide	MG.33.MX.YY
VLT AutomationDrive , 200 and 300 PROFIBUS Operating Instructions	MG.33.CX.YY
VLT AutomationDrive , 200 and 300 DeviceNet Operating Instructions	MG.33.DX.YY
VLT AutomationDrive FC 300 MCT 10 Software Dialogue	MG.33.EX.YY
PROFIBUS DP V1 Design Guide	MG.90.EX.YY

2.7.1. Abbreviations

ACK	ACKnowledge
BOOL	Boolean
CTW	Control Word
EDS	Electronic Data Sheet
EMC	Electromagnetic Compatibility
HF	High Frequency
HPFB	High Performance Field Bus
IBS	Interbus
I/O	Input/Output
LCD	Liquid Crystal Display
LCP	Local Control Panel
LED	Light Emitting Diode
LSB	Least Significant Bit
MSB	Most Significant Bit
MAV	Main Actual Value
MRV	Main Reference Value
N/A	Not applicable
PC	Personal Computer
PCD	Process Data
PCP	Peripherals Communication Protocol
PIW	Peripheral input word
PLC	Programmable Logic Control
PNU	Parameter NUmber
PPO	Parameter-Process Data Object
SINT	Signed integer
STW	Status Word
VSD	Variable Speed Drive
UDINT	Unsigned double integer
UNIT	Unsigned integer

3. How to Install

3.1.1. Cabling

The Interbus network topology is based on a logical ring structure, implemented in a one-cable structure, making a physical bus structure with a bit rate of 500 kbps.
Interbus supports networks with a total cable length of up to 12.8 km, with a maximum of 400 meters between nodes.
The maximum cable length is only achievable when the bus cable has the following properties:

Impedance: 120 ohm ±20% @ 64kHz, 100 ohm ±15% @ >1 MHz.

Resistance: < 9.6 ohm/100 m

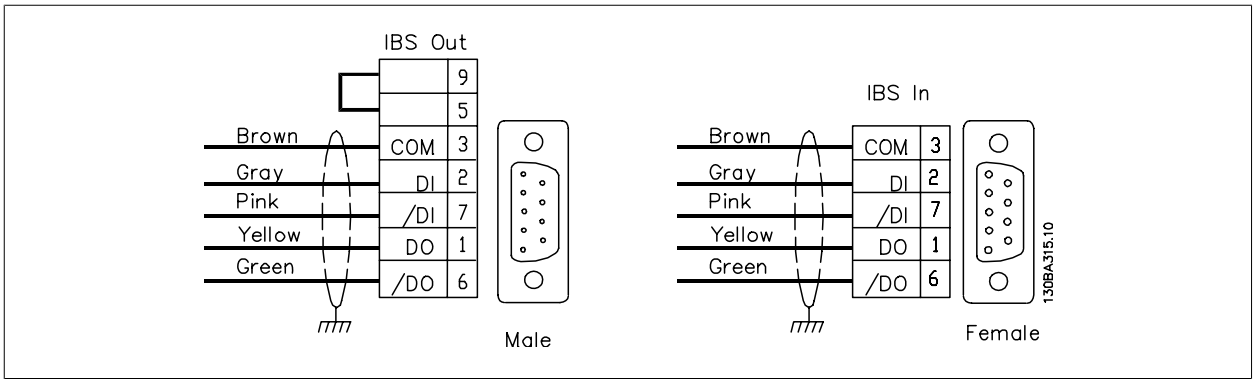
Capacity: < 60 nF/km

Cross section: minimum 0.2 mm2, corresponding to AWG 25

Cable type: twisted in pairs, 3 x 2 wires

Screening: Copper-braided screen or braided screen and foil screen

Use of the same cable type throughout the entire network is recommended in order to avoid impedance mismatch.
The Interbus option has two network interfaces, one for the incoming bus and one for the outgoing bus. Both are D-sub 9 type.



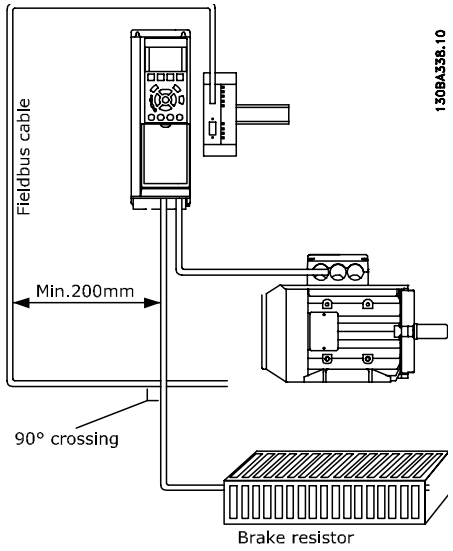
3.2.1. EMC Precautions

The following EMC precautions are recommended in order to achieve interference-free operation of the Interbus network. Additional EMC information is available in the FC 300 series Operating Instructions (MG33AXYY) and Design Guide (MG33BXYY).

NB!
Relevant national and local regulations, for example regarding protective earth connection, must be observed.

3

The Interbus communication cable must be kept away from motor and brake resistor cables to avoid coupling of high frequency noise from one cable to the other. Normally a distance of 200 mm (8 inches) is sufficient, but maintaining the greatest possible distance between the cables is recommended, especially where cables run in parallel over long distances. If the Interbus cable has to cross a motor and brake resistor cable they must cross each other at an angle of 90 degrees.

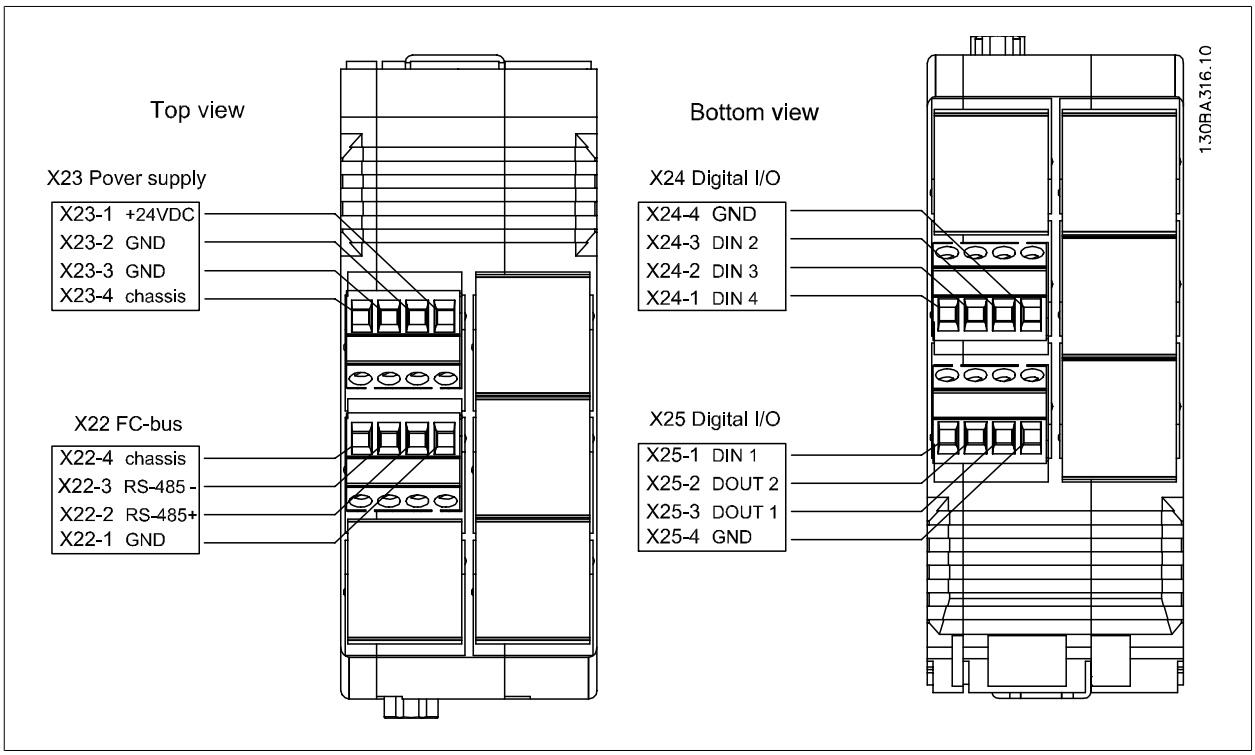


3.3.1. Installation of Option

The Interbus option is installed in its own cabinet, designed for DIN-rail mounting.
The option is connected to the FC 302 via terminal X22 on the option to terminal 68 and 69 on the frequency converter. Screened cable is recommended (120 cm cable supplied with frequency converter).

The RS-485 termination switch on the FC 300 (BUS-TER.) must be set to "ON".

Interbus option	FC 302
X22-1	61 (RS 485 com)
X22-2	68 (RS 485 +)
X22-3	69 (RS 485 -)
X22-4	chassis on FC 300



NB!

Grounding of the Interbus option is mandatory and can be achieved in several ways:

- Via the DIN-rail
- Via the connections X23-4 or X22-4

3.3.2. I/O Specifications

X22: FC-bus	X23: Power supply	X24+25: Digital I/O
RS-485	Voltage level: 24 V dc ± 15% Current consumption: max. 160 mA excluding load on digital outputs.	Digital inputs: Voltage level: 0-24 V DC Voltage level, logic "0":< 5 V DC Voltage level, logic "1":> 9 V DC Maximum input voltage: 28 V DC Minimum input voltage: -28 V DC Frequency range: DC to 250 Hz Duty cycle min. pulse width: 2 ms Input resistance: approx. 4 kΩ Digital outputs: Voltage level: 0-24 V DC (open collector PNP) short-circuit protected. Maximum output current: 25 mA

3.3.3. General Specifications

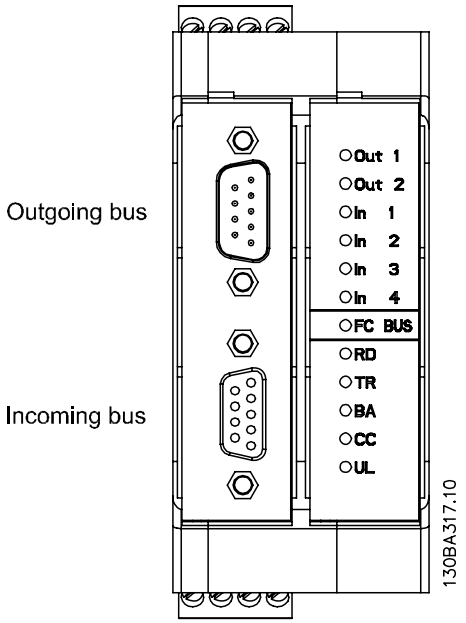
Operating temperature	÷10 - +55°C
Max. relative humidity	5% - 95% non condensing
Enclosure	IP 20

3.4.1. LEDs

3

Name	Colour	Indicates	ON	OFF
Out 1 - Out 2	Green	State of outputs*	Output high	Output low
In 1 - In 4	Green	State of inputs	Input high	Input low
FC BUS	Green	Activity on FC-Bus		
RD	Red	Status of outgoing bus	Out. bus stopped	Out. bus active
TR	Green	Transmit/Receive	PCP comm. running	No PCP comm.
BA	Green	Bus Active	Bus active	Bus stopped
CC	Green	Cable check	Incoming bus active	Incoming bus off
UL	Green	Power O.K.	Voltage O.K.	No voltage

*= Flashing by external short circuit.



3.5. Configure the FC 300

3.5.1. VLT Parameters

Pay particular attention to the following parameters when configuring an FC 300 with an Interbus interface. Please refer to the *Parameters* chapter for more details of each parameter.

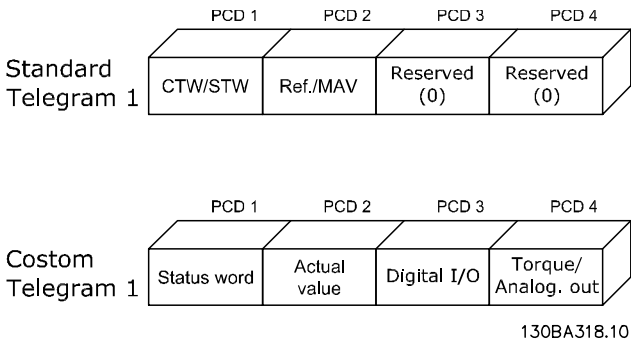
3.5.2. Basic Communication Parameters

These parameters are necessary to establish communication between the Interbus option and the FC 300.

Parameter	Parameter name	Setting
8-01	Control Site	[0] Control Word only
8-32	FC Port Baud Rate	[4] 38400 baud
8-35	Minimum Response Delay	1 ms

The Interbus option is capable of operating with two different telegram-types for process data:

- Standard Telegram 1, is a telegram with 4 PCD's. The two first PCD's is for holding Control word and reference for Master-to-slave comm. And Status word and Main Actual Value for Slave-to-master comm. The last two PCD's (3 and 4) is reserved for future use, and contains only 0's.
- Custom Telegram 1, is a telegram with 4 PCD's that in addition also holds information on digital and analogue I/O's and torque limit.



3.5.3. Standard Telegram 1

In order to interface with the Interbus option, running Standard Telegram 1, the following parameters must be set on the FC 300:

Parameter	Parameter name	Setting
8-40	Telegram Selection	[1] Standard Telegram 1
3-15	Reference Resource 1	[0] No Function
3-16	Reference Resource 2	[0] No Function
8-10	Control Word Profile	[0] FC profile [1] PROFIdrive profile (= Drivecom)

NB!

Setting par. 8-10 to [1] PROFIdrive profile, enables the Drivecom Profile on the Interbus option, i.e. Control word and Status word are interpreted as Drivecom.

Setting par. 8-10 to [0] FC Profile will enable the FC profile on the frequency converter.

See section *How to Control the FC 300* for more information on the different profiles.

3.5.4. Custom Telegram 1

In order to interface with the Interbus option, running Custom Telegram 1, the following parameters must be set on the FC 300:

Parameter	Parameter name	Setting
8-40	Telegram Selection	[200] Custom Telegram 1
3-15	Reference Resource 1	[0] No Function
3-16	Reference Resource 2	[0] No Function
5-01	Terminal 27 mode	[1] Output
5-02	Terminal 29 mode	[1] Output
5-10	Terminal 18 Digital Input	[0] No Operation
5-11	Terminal 19 Digital Input	[0] No Operation
5-12	Terminal 27 Digital Input	[0] No Operation
5-15	Terminal 33 Digital Input	[0] No Operation
5-30	Terminal 27 Digital Output	[45] Bus controlled [46] Bus controlled, 1 if timeout [47] Bus controlled, 0 if timeout
5-31	Terminal 29 Digital Output	[45] Bus controlled [46] Bus controlled, 1 if timeout [47] Bus controlled, 0 if timeout
5-40 [0]	Function Relays, Relay 1	[45] Bus controlled [46] Bus controlled, 1 if timeout [47] Bus controlled, 0 if timeout
5-40 [1]	Function Relays, Relay 2	[45] Bus controlled [46] Bus controlled, 1 if timeout [47] Bus controlled, 0 if timeout
8-10	Control Word Profile	[0] FC profile [1] PROFIdrive profile (= Drivecom)

NB!
If the Interbus option is powered up without connection to a FC300 frequency converter, it will run Standard Telegram 1.
This means that it will not be possible to use any I/O's.

NB!
For the digital- and relay-outputs the reaction in case of a bus-timeout can be selected.
Bus ctrl. [45]: The output is controlled via bus. In case of a bus-timeout the output state is kept at the last known state.
Bus ctrl. 1 if timeout [46]: The output is controlled via bus. In case of a bus-timeout the output state is set to logical 1.
Bus ctrl. 0 if timeout [47]: The output is controlled via bus. In case of a bus-timeout the output state is set to logical 0.

NB!
Setting par. 8-10 to [1] *PROFIdrive profile*, enables the Drivecom Profile on the Interbus option, i.e. Control word and Status word are interpreted as Drivecom.
Setting par. 8-10 to [0] *FC Profile* will enable the FC profile on the frequency converter.
See section *How to Control the FC 300* for more information on the different profiles.

NB!
Par. 0-40 [Hand on] key on LCP.
If the Hand button on the FC 300 is activated, control of the frequency converter via the Interbus interface is disabled.

4. How to Configure the System

4.1.1. Configure the Interbus Network

This section describes how to set up Interbus communication between a Danfoss FC 300 frequency converter and the Phoenix Interbus CMD G4.

4.1.2. Configuring of the CMD and FC 300

The first step is to connect all Interbus slaves to the master and power up all units. Start the IBS CMD software and choose a new project from File and New. The screen should now look like this:

The next step is to read the slaves into the bus system. Click on Configuration frame and click on the right mouse button. Select Read In (from memory).

The state will be changed from Offline to Online when the Read In is finished. Please look at the bottom of the screen. After the Read In, CMD will indicate each VLT frequency converter with a DriveCom symbol, a station number and an ID number.

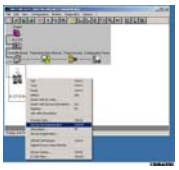
The next step is to configure the Interbus system. This is done by clicking on the VLT symbol and pressing the right mouse button. Select: *Description*.

Here it is possible to type in a Station name, Device name and a Device number. Click on: *Parameter Channel*.

For message length transmit and receive enter 246 byte and select Get-OD (long format). The message length now corresponds to the internal buffer in the VLT frequency converter. Get-OD (long format) means that the master will read the English parameter description text from the VLT frequency converter. Press OK twice.

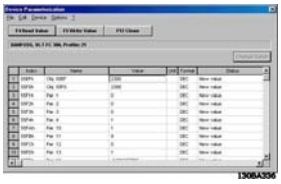
4.1.3. Setting up PCP Communication

Via the CMD tool it is possible to read and write to parameters, and read the English parameter text of each parameter.
To start PCP communication you must be in Monitor state.
Click on the station number and click on the right mouse button and choose: Device *Parameterization*.



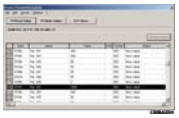
The dialog box will now show Danfoss, VLT FC 300, Profile: 21.
In order to be able to read all parameters into the frequency converter, select: *Device and Read Parameter List*.
The CMD tool will now start reading all parameters, which takes 3-4 minutes.

When all parameters have been read, CMD will show the first parameter 55F1hex Par. 1 at the first row.
55F1hex corresponds to 22001dec.
This means that all FC 300 parameters can be accessed simply by adding 22000dec to the FC 300 parameter.
For example if you want to write to par. 3-41 *Ramp 1 ramp up time*, you must write to 22341dec (5745hex).
The CMD tool can only indicate parameters using hexadecimal numbers.



The two first indexes are for handling the "Max Torque Limit" (par. 4-16 and 4-17) when running Custom Telegram 1.

If you want to change the value of par. 3-41 *Ramp 1 ramp up time* to 10 sec you must write 1000 in column next to index 5745 Hex.
You have to enter 1000 because par. 3-41 has a conversion index of -2 (= 0.01). Highlight the row and click on F5 Write Value.
The ramp up time in par. 3-41 has now been changed to 10 sec.



To activate the new settings with PCD, the CMD needs to read the configuration from the VLT frequency converter again.
Click on the controller board and select Process data. The Process data should now be 64 bits, corresponding to 4 words: control word, reference, PCD 1 and PCD 2.

When the system is running, change the state to: *Monitor*.
Click on the controller board and select: *Address Monitor*.

The Address Monitor shows the I/O area.

E0 Input:
Shows the status word from the frequency converter.

A0 Output:
Is used for sending the control word to the frequency converter.

E2 Input:
Shows the actual output frequency of the frequency converter.

A2 Output:
This I/O area is used to send a speed reference to the frequency converter.

N.B:
Custom Telegram 1 only ! For Standard telegram 1 the below I/O's contain no data.

E4 Input (PCD 3 read):
This I/O area reads the digital inputs. (See section: *Process Data*.)

A4 Output (PCD 4 write):
Writes settings to digital outputs. (See section: *Process Data*.)

E6 Input (PCD 3 read):
This I/O area reads the analogue inputs. (See section: *Process Data*.)

A6 Output (PCD 4 write):
This I/O area is used to send a torque limit to the frequency converter. (See section: *Process Data*.)

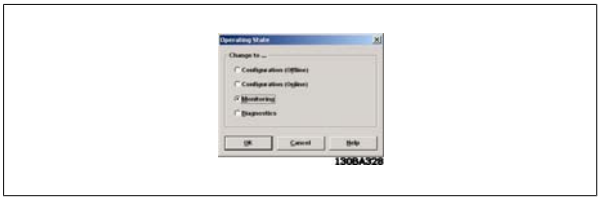
NB!
I/O area: E/A 4 to 6 apply only for Custom Telegram 1.
For Standard Telegram 1 these I/O's contains no data.
See section *How to Control the FC 300* for more information on the different profiles.

The frequency converter is now set up and the program can be downloaded to the PLC master.
This is done by clicking with the right mouse button on the Controller board.
Select: *Parameterization* and *Execute*.

After the parameterization is done, the master will start to run. If you are using a Siemens S7 or S5 master, the LCD will look like this:

4.1.4. Drivecom Profile

The Interbus option has implemented the Drivecom control profile.
By changing the operating state from Online to Monitor it is possible to write the control word and reference to the frequency converter. In Monitor mode it is also possible to read and write to parameters.



NB!
The Drivecom profile is only active if the PROFIdrive profile has been selected in par. 8-10 *Control Word Profile*.

4

Now the built in Drivecom monitor in the CMD tool can be started by right-clicking on the controller board and selecting *Drivecom*.

The Drivecom monitor will now show Danfoss, VLT FC 300, Profile: 21, in the upper left corner.

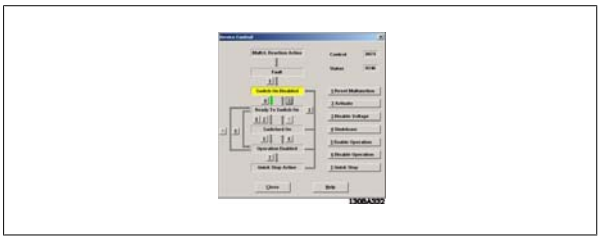
The Drivecom monitor is split up into three parts:
Analog Display, Control Word and Status word.

In the Analog Display part the reference can be set.

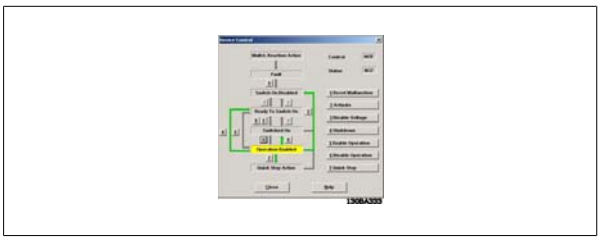
In the Control word part, start and stop-commands can be send to the frequency converter.

In the Status word part the actual status word from the frequency converter is read out. By clicking Settings you can setup the Drivecom monitor.

Click on Device Control to begin controlling the VLT frequency converter.
Please note that the control word will change when the state changes.



Click 4 for Ready to Switch On and click 2 for Switch On.
Upon clicking 5 the VLT frequency converter should start the motor.
The control word is now 7F Hex.
Press Close.



5. How to Control the FC 300

5.1.1. Process Data

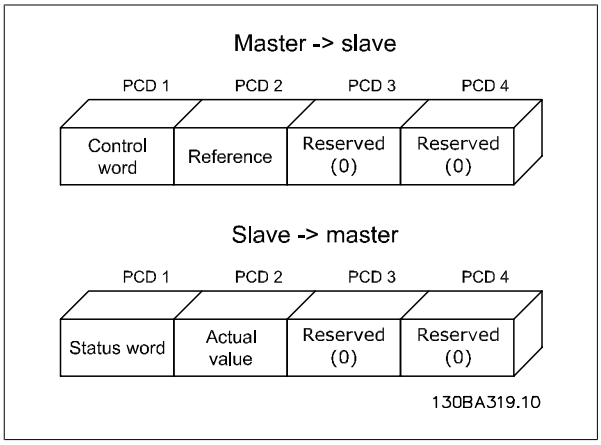
The Process Data provides an agile way of controlling the FC 300 frequency converter. Two different telegram-types are for process data are supported:

- Standard Telegram 1, is a telegram with 4 PCD's. The two first PCD's is for holding Control word and reference for Master-to-slave comm. And Status word and Main Actual Value for Slave-to-master comm. The last two PCD's (3 and 4) is reserved for future use, and contains only 0's.
- Custom Telegram 1, is a telegram with 4 PCD's that in addition also holds information on digital and analogue I/O's and torque limit.

See section *How to Install* for more information on how to select the different telegram profiles.

5.1.2. Standard Telegram 1

The Process Data length is fixed to 4 words, each of two bytes, with the following format:

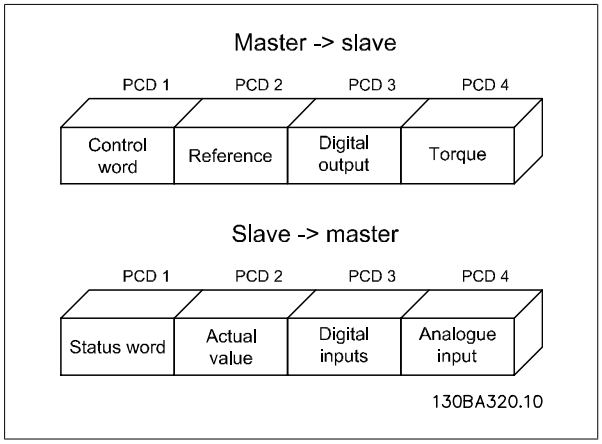


Master → slave		
PCD	Name	Function
1	Control Word	Sends the Control Word to the frequency converter. The format depends of the setting of par. 8-10.
2	Reference	Sends the reference in %. See section: *Bus speed reference value*.

Slave → master		
PCD	Name	Function
1	Status Word	Sends the Status word from the frequency converter. The format depends of the setting of par. 8-10.
2	Actual value	Sends actual output frequency in %. See section: *Bus speed reference Value*.

5.1.3. Custom Telegram 1

The Process Data length is fixed to 4 words, each of two bytes, with the following format:



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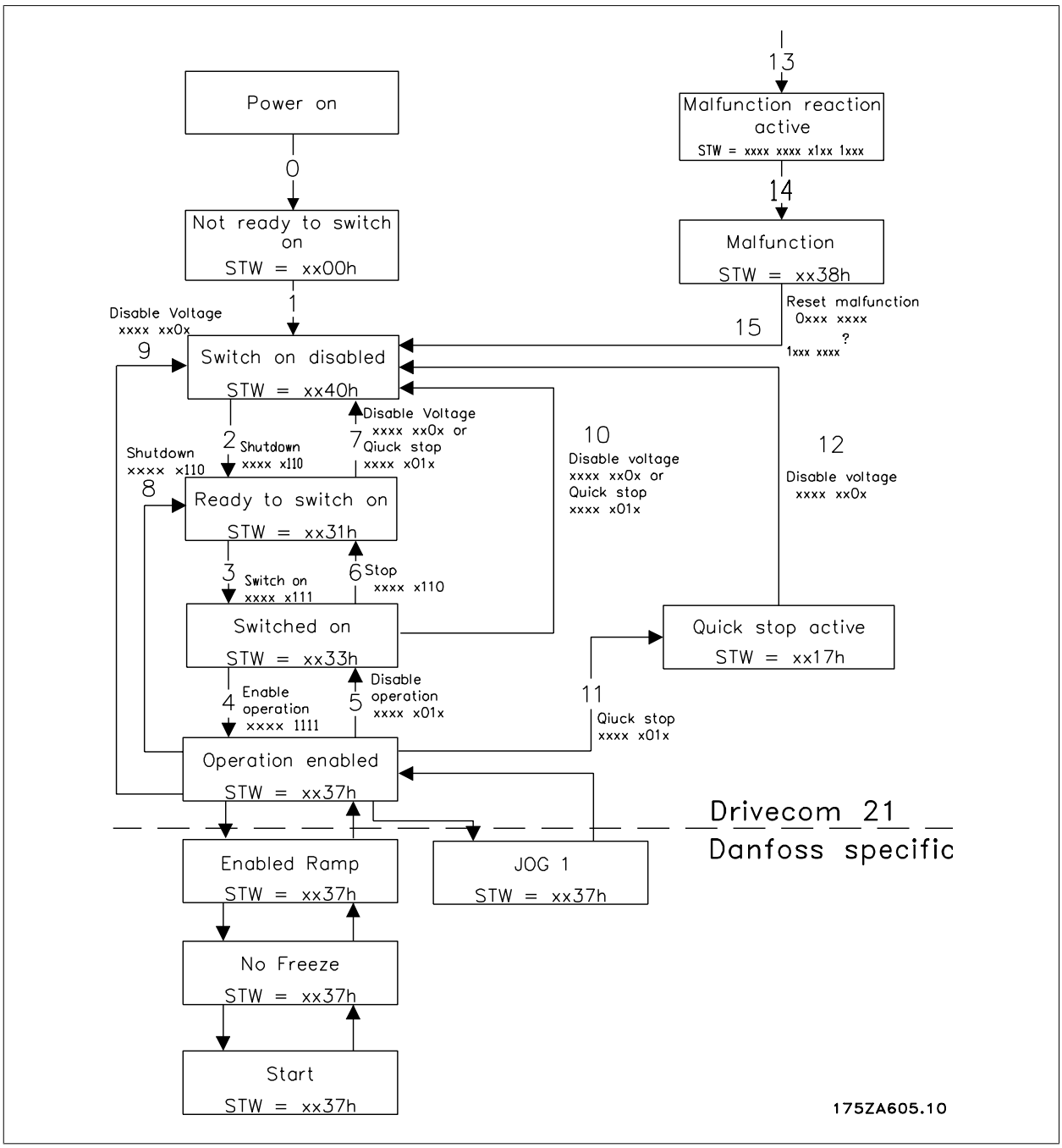


Master → slave		
PCD	Name	Function
1	Control Word	Sends the Control Word to the frequency converter. The format depends of the setting of par. 8-10.
2	Reference	Sends the reference in %. See section: *Bus speed reference value*.
3	Digital outputs (bit=1 → output=high)	Bit 0: Output 27 Bit 1: Output 29 Bit 2: Relay 1 Bit 3: Relay 2 Bit 4-13: Reserved Bit 14: Output DOUT 1 (X25-2) on Interbus option Bit 15: Output DOUT 2 (X25-3) on Interbus option
4	Torque	Sets torque limits in Motor and Generator mode, par. 4-16 and 4-17. **N.B.:** A value of "0" (zero) is not accepted, but discarded by the option.

Slave → master		
PCD	Name	Function
1	Status Word	Sends the Status word from the frequency converter. The format depends of the setting of par. 8-10.
2	Actual value	Sends actual output frequency in %. See section: *Bus speed reference Value*.
3	Digital inputs (bit=1 → input=high)	Bit 0: Input 33 Bit 1: Input 32 Bit 2: Input 29 Bit 3: Input 27 Bit 4: Input 19 Bit 5: Input 18 Bit 6-11: Reserved Bit 12: Input DIN 1 (X25-1) on Interbus option Bit 13: Input DIN 2 (X24-2) on Interbus option Bit 14: Input DIN 3 (X24-3) on Interbus option Bit 15: Input DIN 4 (X24-4) on Interbus option
4	Analogue input	Reads out analogue input 53 as an absolute value. Term.53 can work as a voltage (0-10V) or a current (0-20mA) input, depending on the setting of S201. S201=0 → voltage, S201=1 → current.

5

NB!

If the connection to the Interbus master is lost, all outputs on the Interbus option are set to 0.

NB!

Setting par. 8-10 to [1] *PROFIdrive profile*, enables the Drivecom Profile on the Interbus option, i.e. Control word and Status word are interpreted as Drivecom.

Setting par. 8-10 to [0] *FC Profile* will enable the FC profile on the frequency converter.

See section *How to Control the FC 300* for more information on the different profiles.

NB!

If the Interbus option is powered up without connection to a FC300 frequency converter, it will run Standard Telegram 1. This means that it will not be possible to use any I/O's.

Examples:

Setting the torque limit in PCD 4 (master → slave):

Conversion index is -1.

500hex = 1280dec = 128% torque.

Reading the analogue input in PCD 4 (slave → master):

Conversion index is -3.

3456dec = 3,456 volt.

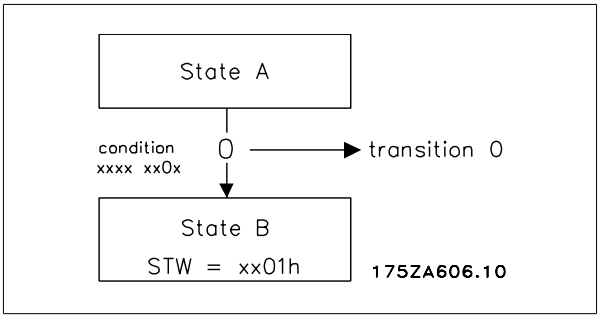
5.1.4. Timing of PCDs

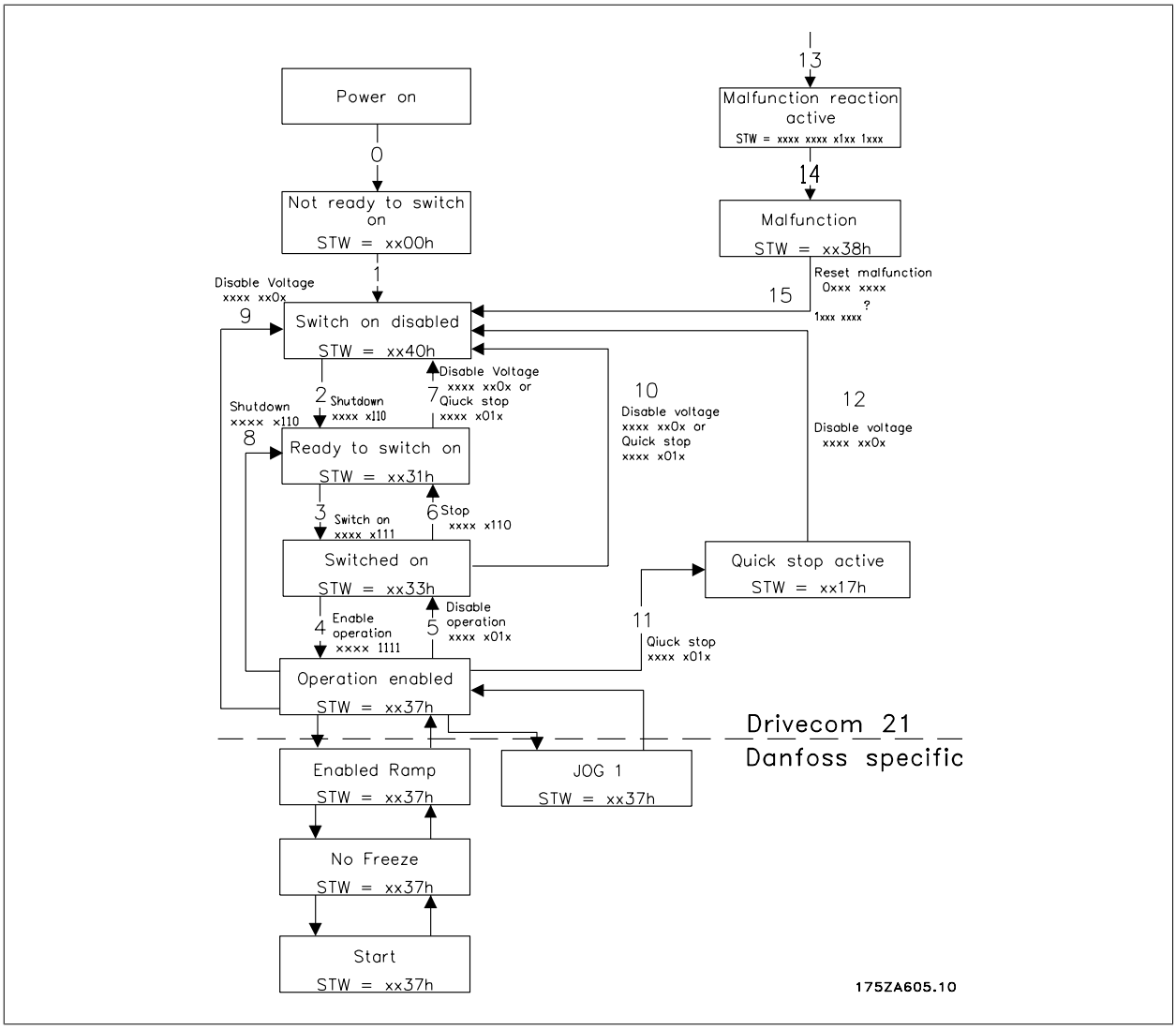
Function	Time
CTW, MRV, STW, MAV	15ms from sending CTW/MRV until receipt of STW/MAV
Update of I/O on frequency converter	60-200ms
Update of I/O on option	1-2ms

5.2.1. The Drivecom State Machine

The state machine describes the device status and the possible control sequence of the frequency converter. A status represents a specific internal and external response. By means of device control commands and/or internal events, the status can be changed and a control sequence thus executed. The current status can be read out via the frequency converter's status word.

The flow chart to the right and the following explanation may help to understand the principle: To change from state A to state B, the condition "Control word bit 1" has to be set to 0. This causes the transition 0 to be executed. In state B the status word is: xx01H.





5.2.2. Description of Transitions

The following describes each transaction that the Drivecom state machine executes for a given command.

0 Input of the state machine → NOT READY TO SWITCH ON.
Event: - Reset
Action: - Start self-test - Start initialization

1 NOT READY TO SWITCH ON → SWITCH ON DISABLED
Event: - Error-free self-test - Initialization completed without errors occurring.
Action: - Activate communication and process data monitoring.

2 SWITCH ON DISABLED → READY TO SWITCH ON
Event: - "Shutdown" command
Condition: - Dependent on the manufacturer-specific requirements (e.g. power section ready)
Action: - None

3 READY TO SWITCH ON → SWITCHED ON
Event: - "Switch-on" command
Action: - The power section is switched on if it is not already switched on.

4 SWITCHED ON → OPERATION ENABLED
Event: - "Enable-Operation" command
Action: - Enable drive function

5 OPERATION ENABLED → SWITCHED ON
Event: - "Disable-Operation" command
Action: - Execute the parameter-definable "Drive- Disable-Function"

6 SWITCHED ON → READY TO SWITCH ON
Event: - "Shutdown" command
Action: - The power section can be switched off

7 READY TO SWITCH ON → SWITCH ON DISABLED
Event: - "Quick-Stop" or "Disable-Voltage" command
Action: - None

8 OPERATION ENABLED → READY TO SWITCH ON
Event: - "Shutdown" commands
Action: - Execute the parameter definable "Drive- Disable-Function"
- The power section can be switched off

9 OPERATION ENABLED → SWITCH ON DISABLED
Event: - "Disable-Voltage" command
Action: - Disable drive function
- The power section can be switched off

10 SWITCHED ON → SWITCH ON DISABLED
Event: - "Disable-Voltage" command
or - "Quick-Stop" command
Action: - The power section can be switched off

11 OPERATION ENABLED → QUICK STOP ACTIVE
Event: - "Quick-Stop" command
Action: - Trigger the parameter-definable "Quick - Stop-Function"

12 QUICK STOP ACTIVE → SWITCH ON DISABLED

Event: - Quick stop has been completed or - "Disable-Voltage" command

Action: - Disable drive function

- The power section can be switched off

13 All states → MALFUNCTION REACTION ACTIVE

Event: - Drive malfunction detected Action: - Trigger malfunction reaction depending on the fault

14 MALFUNCTION REACTION ACTIVE → MALFUNCTION

Event: - Malfunction reaction concluded

Action: - Disable drive function

- The power section can be switched off

15 MALFUNCTION → SWITCH ON DISABLED

Event: - "Malfunction-Reset" command

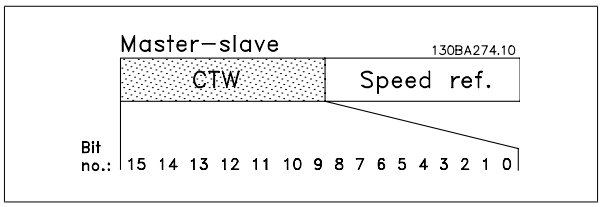
Condition: - Malfunction is no longer present

Action: - Malfunction reset is executed

5.3. Drivecom 21 Control Profile

5.3.1. Control Word according to Drivecom 21 Profile

(Par. 8-10 = PROFIdrive profile)



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Bit	Bit value = 0	Bit value = 1
00	Switch off	Switch on
01	Disable voltage	Enable voltage
02	Quick stop	Run
03	Disable operation	Enable operation
04	Disable ramp	Enable ramp
05	Freeze	Run enable
06	Ramp stop	Start
07	No function	Reset
08	Reserved	
09	Reserved	
10	Reserved	
11	Jog 1 OFF	Jog 1 ON
12	Reserved	
13	Setup select (LSB)	
14	Setup select (MSB)	
15	Forward	Reversing

Explanation of the Bits:

Bit 00, Switch OFF/ON:
Bit 00= "0" execute transition 2, 6 or 8.
Bit 00 = "1" execute transition 3.

Bit 01, Disable/Enable Voltage:
Bit 01= "0" execute transition 9, 10 or 12.
Bit 01 = "1" = "Enable Voltage".

Bit 02, Quick stop/Run:
Bit 02= "0" execute transition 7, 10 or 11.
Bit 02 = "1" = Quick stop not active.

Bit 03, Disable/enable Operation:
Bit 03= "0" execute transition 5.
Bit 03 = "1" = "Enable operation".

Bit 04, Quick-stop/ramp:
Bit 04= "0" execute transition 7 or 11, Quick stop.
Bit 04 = "1" = Enable ramp.

Bit 05, Freeze output frequency/run enable:
Bit 05 = "0" means that the given output frequency is maintained even if the reference is changed.
Bit 05 = "1" means that the frequency converter is again able to regulate, and the given reference is followed.

Bit 06, Ramp stop/start:
Bit 06= "0" The VLT controls the motor down to stop.
Bit 06 = "1" = Start command to the VLT is given.

Bit 07, No function/reset:
Reset of trip.
Bit 07 = "0" means that there is no reset.
Bit 07 = "1" means that a trip is reset.

Bit 08, 09 and 10:
Drivecom reserved.

Bit 11, Jog 1 OFF/ON:
Activation of pre-programmed speed in par. 8-90 Bus JOG 1. JOG 1 is only possible if Bit 04 = "0", and bit 00 to 03 = "1".

Bit 12:
Danfoss reserved.

Bits 13/14, Selection of Setup:
Bits 13 and 14 are used for choosing among the four menu Setups in accordance with the following table:

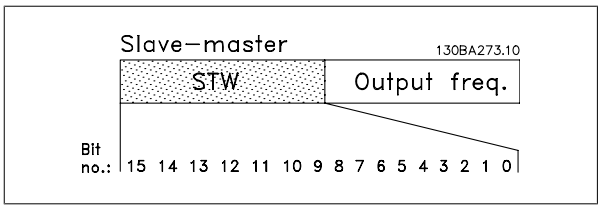
Bit 14	Bit 13	Setup
0	0	1
0	1	2
1	0	3
1	1	4

Bit 15, Forward/reversing:
Bit 15 = "0" leads to no reversing.
Bit 15 = "1" leads to reversing.

Note: In factory setting reversing is set to [digital] in par. 8-54 *Reversing select*.

5.3.2. Status Word according to Drivecom 21 Profile

(Par. 8-10 = PROFIdrive profile)



Bit	Bit value = 0	Bit value = 1
00	Not ready to switch ON	Ready to switch ON
01	Switched OFF	Switched ON
02	Operation disabled	Operation enabled
03	No malfunction	Malfunction
04	Voltage disabled	Voltage enabled
05	Quick stop	Run
06	Switch on disable	Switch on enable
07	No warning	Warning
08	Reserved	
09	Remote disabled	Remote enabled
10	Setpoint not reached	Setpoint reached
11	Speed limit not active	Speed limit active
12	Reserved	
13	Reserved	
14	Not running	Running
15	Torque limit o.k.	Torque limit exceeded

Explanation of the Bits:

Bit 00, Not ready to switch on/Ready to switch on:
Bit 00 = "0" state less than "Ready to switch on".
Bit 00 = "1" state at least = "Ready to Switch on".

Bit 01, Switch off/Switch on:
Bit 00 = "0" state less than "Switched on".
Bit 00 = "1" state at least = "Switched on".

Bit 02, Operation disable/Operation enable:
Bit 00 = "0" state less than "Operation enable".
Bit 00 = "1" state at least = "Operation enable".

Bit 03, No Malfunction/Malfunction:
Bit 03 = "0" means that the connection from Interbus option to is o.k.
Bit 03 = "1" means that the connection between Interbus option and has been lost, or no is found.

Bit 04, Voltage disable/Voltage enable:
Bit 04 = "0" means that control word bit 01 = "1".
Bit 04 = "1" means that control word bit 01 = "0".

Bit 05, Quick stop/Run:
Bit 05 = "0" means that control word bit 02 = "1".
Bit 05 = "1" means that control word bit 02 = "0".

Bit 06, Start enable/Start disable:
Bit 06 = "0" state is "Switch on disable".
Bit 06 = "1" state is "Switch on enable".

Bit 07, No warning/Warning:
Bit 07 = "0" means that there is no warning situation.
Bit 07 = "1" means that a warning has occurred.

Bit 08, Danfoss reserved

Bit 09, Remote disable/Remote enable:
Bit 09 = "0" means that the has been stopped by means of the stop key on the LCP, or that [Local] has been selected in par. 3-13 Reference site.
Bit 09 = "1" means that it is possible to control the converter via the serial port.

Bit 10, Setpoint not reached/Setpoint reached:
Bit 10 = "0" means that the actual motor speed is different from the speed reference set. This can be the case while the speed is ramped up/down during start/stop.
Bit 10 = "1" means that the present motor speed equals the speed reference set.

Bit 11, Speed limit not active/speed limit active:
Bit 11 = "0" means that the output frequency is out of the range set in par. 4-11/4-12 Motor Speed low Limit RPM/Hz or par. 4-13/4-14 Motor Speed high Limit RPM/Hz.
Bit 11 = "1" means that the output frequency is within the mentioned range.

Bit 12, Drivecom reserved

Bit 13, Drivecom reserved

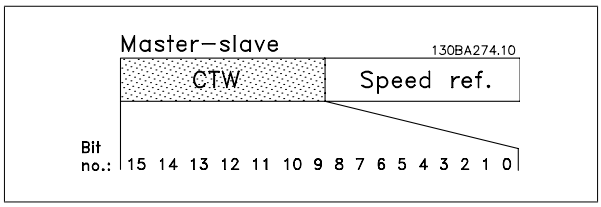
Bit 14, Running/Not running:
Bit 14 = "0" means that the motor is not running.
Bit 14 = "1" means that the has a valid start signal or that the output frequency is greater than 0 Hz.

Bit 15, Torque limit o.k./Torque limit exceeded:
Bit 15 = "0" means the torque limit received via PDC 4 is accepted and within range.
Bit 15 = "1" means the torque limit received exceeds the limits in par. 4-15 and 4-16.

5.4. Danfoss FC Control Profile

5.4.1. Control Word according to FC Profile

(Par. 8-10 = FC profile)



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Bit	Bit value = 0	Bit value = 1
00	Reference value	External selection lsb
01	Reference value	External selection msb
02	DC brake	Ramp
03	Coasting	No coasting
04	Quick stop	Ramp
05	Hold output frequency	Use ramp
06	Ramp stop	Start
07	No function	Reset
08	No function	Jog
09	Ramp 1	Ramp 2
10	Data invalid	Data valid
11	No function	Relay 01 active
12	No function	Relay 04 active
13	Parameter set-up	Selection lsb
14	Parameter set-up	Selection msb
15	No function	Reverse

Explanation of the Control Bits:

Bits 00/01

Bits 00 and 01 are used to choose between the four reference values, which are pre-programmed in par. 3-10 *Preset Reference* according to the following table:

Programmed ref. value	Parameter	Bit 01	Bit 00
1	3-10 [0]	0	0
2	3-10 [1]	0	1
3	3-10 [2]	1	0
4	3-10 [3]	1	1

NB!
In par. 8-56 *Preset Reference Select* a selection is made to define how Bit 00/01 gates with the corresponding function on the digital inputs.

Bit 02, DC brake:

Bit 02 = '0' leads to DC braking and stop.

Braking current and duration are set in par. 2-01 *DC Brake Current* and 2-02 *DC Braking Time*.

Bit 02 = '1' leads to ramping.

Bit 03, Coasting:

Bit 03 = '0' causes the frequency converter to immediately "let go" of the motor (the output transistors are "shut off"), so that it coasts to a standstill.

Bit 03 = '1' enables the frequency converter to start the motor if the other starting conditions have been fulfilled.

NB!
In par. 8-50 *Coasting Select* a selection is made to define how Bit 03 gates with the corresponding function on a digital input.

Bit 04, Quick stop:

Bit 04 = '0' causes a stop, in which the motor speed is ramped down to stop via par. 3-81 *Quick Stop Ramp Time*.

Bit 05, Hold output frequency:

Bit 05 = '0' causes the present output frequency (in Hz) to freeze. The frozen output frequency can then be changed only by means of the digital inputs (par. 5-10 to 5-15) programmed to *Speed up* and *Speed down*.

NB!
If Freeze output is active, the frequency converter can only be stopped by the following:

- Bit 03 Coasting stop
- Bit 02 DC braking
- Digital input (par. 5-10 to 5-15) programmed to *DC braking*, *Coasting stop* or *Reset* and *Coasting stop*.

Bit 06, Ramp stop/start:

Bit 06 = '0' causes a stop, in which the motor speed is ramped down to stop via the selected *ramp down* parameter.

Bit 06 = '1' permits the frequency converter to start the motor, if the other starting conditions have been fulfilled.

NB!
In par. 8-53 *Start Select* a selection is made to define how Bit 06 Ramp stop/start gates with the corresponding function on a digital input.

Bit 07, Reset:

Bit 07 = '0' does not cause a reset.

Bit 07 = '1' causes the reset of a trip. Reset is activated on the signal's leading edge, i.e. when changing from logic '0' to logic '1'.

Bit 08, Jog:
Bit 08 = '1' causes the output frequency to be determined by par. 3-19 *Jog Speed*.

Bit 09, Selection of ramp 1/2:
Bit 09 = "0" means that ramp 1 is active (par. 3-40 to 3-47).
Bit 09 = "1" means that ramp 2 (par. 3-50 to 3-57) is active.

Bit 10, Data not valid/Data valid:
Is used to tell the frequency converter whether the control word is to be used or ignored.
Bit 10 = '0' causes the control word to be ignored,
Bit 10 = '1' causes the control word to be used.
This function is relevant, because the control word is always contained in the telegram, regardless of which type of telegram is used, i.e. it is possible to turn off the control word if you do not wish to use it in connection with updating or reading parameters.

Bit 11, Relay 01:
Bit 11 = "0" Relay not activated.
Bit 11 = "1" Relay 01 activated, provided *Control word bit 11* has been chosen in par. 5-40 *Function Relay*.

Bit 12, Relay 04:
Bit 12 = "0" Relay 04 has not been activated.
Bit 12 = "1" Relay 04 has been activated, provided *Control word bit 12* has been chosen in par. 5-40 *Function Relay*.

Bit 13/14, Selection of set-up:
Bits 13 and 14 are used to choose from the four menu set-ups according to the following table:

Setup	Bit 14	Bit 13
1	0	0
2	0	1
3	1	0
4	1	1

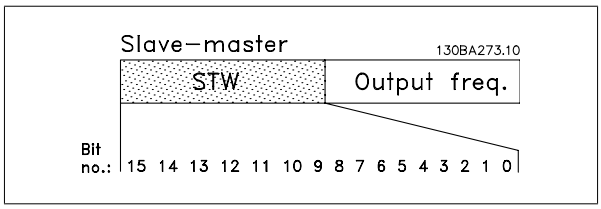
The function is only possible when *Multi-Set-ups* is selected in par. 0-10 *Active Set-up*.

NB!
In par. 8-55 *Set-up Select* a selection is made to define how Bit 13/14 gates with the corresponding function on the digital inputs.

Bit 15 Reverse:
Bit 15 = '0' causes no reversing.
Bit 15 = '1' causes reversing.
Note: In the factory setting reversing is set to *digital* in par. 8-54 *Reversing Select*.
Bit 15 causes reversing only when *Ser. communication*, *Logic or* or *Logic and* is selected.

5.4.2. Status Word according to FC Profile (STW)

(Par. 8-10 = FC profile)



Bit	Bit value = 0	Bit value = 1
00	Control not ready	Control ready
01	Drive not ready	Drive ready
02	Coasting	Enable
03	No error	Trip
04	No error	Error (no trip)
05	Reserved	-
06	No error	Trip lock
07	No warning	Warning
08	Speed ≠ reference	Speed = reference
09	Local operation	Bus control
10	Out of frequency limit	Frequency limit ok
11	No operation	In operation
12	Drive ok	Stopped, auto start
13	Voltage ok	Voltage exceeded
14	Torque ok	Torque exceeded
15	Timer ok	Timer exceeded

Explanation of the Status Bits:

Bit 00, Control not ready/ready:
Bit 00 = '0' means that the frequency converter has tripped.
Bit 00 = '1' means that the frequency converter controls are ready, but that the power component is not necessarily receiving any power supply (in case of external 24 V supply to controls).

Bit 01, Drive ready:
Bit 01 = '1'. The frequency converter is ready for operation, but there is an active coasting command via the digital inputs or via serial communication.

Bit 02, Coasting stop:
Bit 02 = '0'. The frequency converter has released the motor.
Bit 02 = '1'. The frequency converter can start the motor when a start command is given.

Bit 03, No error/trip:
Bit 03 = '0' means that the frequency converter is not in fault mode.
Bit 03 = '1' means that the frequency converter is tripped, and that a reset signal is required to re-establish operation.

Bit 04, No error/error (no trip):
Bit 04 = '0' means that the frequency converter is not in fault mode.
Bit 04 = "1" means that there is a frequency converter error but no trip.

Bit 05, Not used:
Bit 05 is not used in the status word.

Bit 06, No error / trip lock:
Bit 06 = '0' means that the frequency converter is not in fault mode.
Bit 06 = "1" means that the frequency converter is tripped, and locked.

Bit 07, No warning/warning:
Bit 07 = '0' means that there are no warnings.
Bit 07 = '1' means that a warning has occurred.

Bit 08, Speed≠ reference/speed = reference:
Bit 08 = '0' means that the motor is running, but that the present speed is different from the preset speed reference. For example, this might occur while the speed is being ramped up/down during start/stop.
Bit 08 = '1' means that the present motor present speed matches the preset speed reference.

Bit 09, Local operation/bus control:
Bit 09 = '0' means that [STOP/RESET] is activated on the control unit, or that *Local control* in par. 3-13 *Reference site* is selected.
It is not possible to control the frequency converter via serial communication.
Bit 09 = '1' means that it is possible to control the frequency converter via the fieldbus/ serial communication.

Bit 10, Out of frequency limit:
Bit 10 = '0', if the output frequency has reached the value in par. 4-11 *Motor Speed Low Limit* or par. 4-13 *Motor Speed High Limit*.
Bit 10 = "1" means that the output frequency is within the defined limits.

Bit 11, No operation/in operation:
Bit 11 = '0' means that the motor is not running.
Bit 11 = '1' means that the frequency converter has a start signal or that the output frequency is greater than 0 Hz.

Bit 12, Drive OK/stopped, auto start:
Bit 12 = '0' means that there is no temporary over temperature on the inverter.
Bit 12 = '1' means that the inverter has stopped because of over temperature, but that the frequency converter has not tripped and will resume operation once the over temperature stops.

Bit 13, Voltage OK/limit exceeded:
Bit 13 = '0' means that there are no voltage warnings.
Bit 13 = '1' means that the DC voltage in the frequency converter's intermediate circuit is too low or too high.

Bit 14, Torque OK/limit exceeded:
Bit 14 = '0' means that the motor current is lower than the torque limit selected in par. 4-18 *Current Limit*.
Bit 14 = '1' means that the torque limit in par. 4-18 *Current Limit* has been exceeded.

Bit 15, Timer OK/limit exceeded:

Bit 15 = '0' means that the timers for motor thermal protection and VLT thermal protection, respectively, have not exceeded 100%.

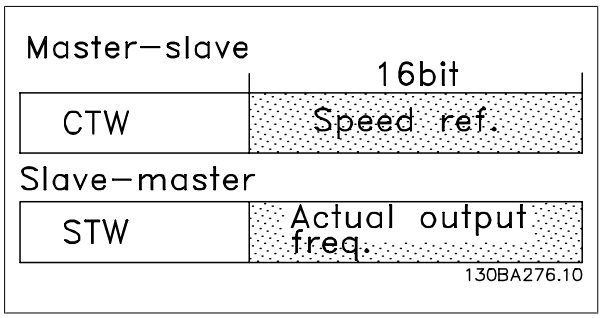
Bit 15 = '1' means that one of the timers has exceeded 100%.

NB!

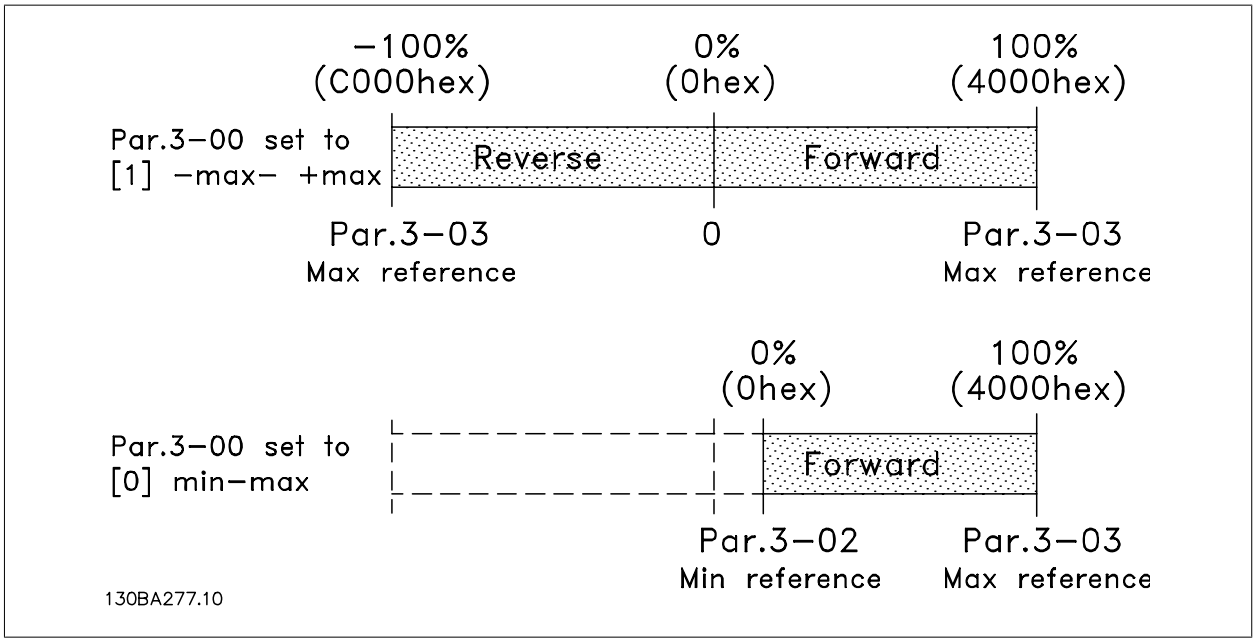
All bits in the STW is set to '0' if the connection between the Interbus option and the frequency converter is lost, or an internal communication problem has occurred.

5.4.3. Bus Speed Reference Value

The speed reference value is transmitted to the frequency converter in a relative value in %.
The value is transmitted in the form of a 16-bit word; in integers (0-32767) the value 16384 (4000 Hex) corresponds to 100%.
Negative figures are formatted by means of 2's complement.
The Actual Output frequency (MAV) are scaled in the same way as the bus reference.



The reference and MAV are scaled as follows:



For examples on reference scaling please refer to section: *Troubleshooting*.

6. How to Access the FC 300 Parameters

6.1. PCP Communication

For read and write of FC 300 parameters, the Interbus Peripherals Communication Protocol (PCP) channel has to be used.
The Danfoss FC 300 Interbus option supports the following services:

- Initiate: Establish connection between master and the FC 300.
- Abort: Cancel connection between master and FC 300.
- Read: Read FC 300 Parameters.
- Write: Write FC 300 Parameters.
- Get Object description: Both short and long are supported.
- Identify: Identification of the FC 300 to the Master.

The following entries must be made in the Master for PCP communication:

Communication reference	2
Transmit buffer length	246
Receive buffer length	246
Supported service request	80 30 00 hex
Supported service response	00 00 00 hex

All parameters in the FC 300 are mapped to the Danfoss specific objects, starting from object 22000 = 55F0hex.
The first object is 22001 (55F1hex), which corresponds to par. 0-01.
22002 corresponds to par. 0-02 and so on.
This means that all parameters can be accessed by using PCP communication, just by adding 22000D to the FC 300 parameter.
To access FC 300 objects for reading and writing, it is necessary to set up the correct data size and index for the particular parameter.
The option board can provide the complete list of objects to the user by using the GET OD command.
Alternatively the user can set up the command for the object manually.

7

7. Parameters

8-01 Control Site

The setting in this parameter overrules the settings in par. 8-50 to 8-56.

Option:		Function:
[0] *	Digital and ctrl. word	Select *Digital and ctrl. word* [0] for control using both digital input and control word.
[1]	Digital only	Select *Digital only* [1] for control using digital inputs only.
[2]	Control word only	Select *Control word only* [2] for control using control word only

NB!
Must be set to [2] *Control word only* for operation with the Interbus option.

8-02 Control Word Source

Select the source of the control word: one of two serial interfaces or four installed options. During initial power-up, the frequency converter automatically sets this parameter to *Option A* [3] if it detects a valid fieldbus option installed in slot A. If the option is removed, the frequency converter detects a change in the configuration, sets par. 8-02 *Control Word Source* back to default setting *FC RS485*, and the frequency converter then trips. If an option is installed after initial power-up, the setting of par. 8-02 *Control Word Source* will not change but the frequency converter will trip and display: Alarm 67 *Option Changed*.

This parameter cannot be adjusted while the motor is running.

Option:	Function:
[0]	None
[1]	FC RS485
[2]	FC USB
[3] *	Option A
[4]	Option B
[5]	Option C0
[6]	Option C1
[30]	External Can

8-03 Control Word Timeout Time

Range:		Function:
1.0 s*	[0.1 - 18000.0 s]	Enter the maximum time expected to pass between the reception of two consecutive telegrams. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in par. 8-04 Control *Word Timeout Function* will then be carried out. The time-out counter is triggered by a valid control word.

8-04 Control Word Timeout Function

Select the time-out function. The time-out function activates when the control word fails to be updated within the time period specified in par. 8-03 *Control Word Time-out Time*

Option:		Function:
[0] *	Off	Resume control via serial bus (Fieldbus or standard) using the most recent control word.
[1]	Freeze output	Freeze output frequency until communication resumes.
[2]	Stop	Stop with auto restart when communication resumes.
[3]	Jogging	Run the motor at JOG frequency until communication resumes.
[4]	Max. speed	Run the motor at maximum frequency until communication resumes.
[5]	Stop and trip	Stop the motor, then reset the frequency converter in order to restart: via the fieldbus, via the reset button on the LCP or via a digital input.

NB!
Must be set to [5] *Stop and trip* for operation with the Interbus option.

[7]	Select set-up 1	This option changes the set-up upon reestablishment of communication following a control word time-out. If communication resumes causing the time-out situation to disappear, par. 8-05 *End-of-time-out Function* defines whether to resume the set-up used before the time-out or to retain the set-up endorsed by the time-out function. Note the following configuration required in order to change the set-up after a time-out: Set Par. 0-10 *Active set-up to Multi set-up* [9], and select the relevant link in par. 0-12 *This Set-up Linked To*.
[8]	Select set-up 2	This option changes the set-up upon reestablishment of communication following a control word time-out. If communication resumes causing the time-out situation to disappear, par. 8-05 *End-of-time-out Function* defines whether to resume the set-up used before the time-out or to retain the set-up endorsed by the time-out function. Note the following configuration required in order to change the set-up after a time-out: Set Par. 0-10 *Active set-up to Multi set-up* [9], and select the relevant link in par. 0-12 *This Set-up Linked To*.
[9]	Select set-up 3	This option changes the set-up upon reestablishment of communication following a control word time-out. If communication resumes causing the time-out situation to disappear, par. 8-05 *End-of-time-out Function* defines whether to resume the set-up used before the time-out or to retain the set-up endorsed by the time-out function. Note the following configuration required in order to change the set-up after a time-out: Set Par. 0-10 *Active set-up to Multi set-up* [9], and select the relevant link in par. 0-12 *This Set-up Linked To*.
[10]	Select set-up 4	This option changes the set-up upon reestablishment of communication following a control word time-out. If communication resumes causing the time-out situation to disappear, par. 8-05 *End-of-time-out Function* defines whether to resume the set-up used before the time-out or to retain the set-up endorsed by the time-out function. Note the following configuration required in order to change the set-up after a time-out: Set Par. 0-10 *Active set-up to Multi set-up* [9], and select the relevant link in par. 0-12 *This Set-up Linked To*.

8-05 End-of-Timeout Function

Option:		Function:
		Select the action after receiving a valid control word following a time-out. This parameter is active only when par. 8-04 Control *Timeout Function* is set to [Set-up 1-4].
[0]	Hold set-up	Retains the set-up selected in par. 8-04 Control *Timeout Function* and displays a warning, until par. 8-06 Reset *Control Timeout* toggles. Then the frequency converter resumes its original set-up.
[1] *	Resume set-up	Resumes the set-up active prior to the time-out.

8-06 Reset Control Word Timeout

This parameter is active only when *Hold set-up* [0] has been selected in par. 8-05 *End-of-Timeout Function*.

Option:		Function:
[0] *	Do not reset	Retains the set-up specified in par. 8-04 Control *Word Timeout Function*, following a control word time-out.
[1]	Do reset	Returns the frequency converter to the original set-up following a control word time-out. The frequency converter performs the reset and then immediately reverts to the *Do not reset* [0] setting

8-07 Diagnosis Trigger

Option:		Function:
		This parameter has no function for LonWorks.
[0] *	Disable	
[1]	Trigger on alarms	
[2]	Trigger alarm/warn.	

8-10 Control Word Profile

Select the interpretation of the control and status words corresponding to the installed fieldbus. Only the selections valid for the fieldbus installed in slot A will be visible in the LCP display.

Option:		Function:
[0] *	FC profile	For guidelines in selection of *FC profile* [0] please refer to the *Serial communication via RS 485 Interface* section in the *How to Programme* chapter.
[1]	PROFIdrive profile	For guidelines in selection of *PROFIdrive profile* [1] please refer to the *Serial communication via RS 485 Interface* section in the *How to Programme* chapter. For additional guidelines in the selection of *PROFIdrive profile* [1], please refer to the Operating Instructions for the installed fieldbus. **NB!** Setting par. 8-10 to [1] *PROFIdrive profile* enables the Drivecom Profile on the Interbus option, i.e. Control word and Status word are interpreted as Drivecom. Setting par. 8-10 to [0] *FC Profile* enables the FC profile on the frequency converter.
[5]	ODVA	For additional guidelines in the selection of *ODVA* [5], please refer to the Operating Instructions for the installed fieldbus.
[7]	CANopen DSP 402	For additional guidelines in the selection of *CANopen DSP 402* [7], please refer to the Operating Instructions for the installed fieldbus.

8-32 FC Port Baud Rate

Baud rate selection for the FC (standard) port.

Option:		Function:
[0]	2400 Baud	
[1]	4800 Baud	
[2] *	9600 Baud	
[3]	19200 Baud	
[4]	38400 Baud	**NB!** Must be set to 38400 Baud [4] for operation with the Interbus option.
[7]	115200 Baud	

8-40 Telegram Selection

This parameter enables to select the telegram type used on Interbus.
For more information on telegram types, please refer to chapter: *How to Control the FC 300*.

Option:		Function:
[1]	Standard telegram 1	
[200]	Custom telegram 1	

8-50 Coasting Select

Option:		Function:
		Select control of the coasting function via the terminals (digital input) and/or via the bus.
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

NB!
This parameter is active only when par. 8-01 Control *Site* is set to [0] *Digital and control word*.

8-51 Quick Stop Select

Option:		Function:
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	Select control of the Quick Stop function via the terminals (digital input) and/or via the bus.

NB!
This parameter is active only when par. 8-01 Control *Site* is set to [0] *Digital and control word*.

8-52 DC Brake Select

Option:		Function:
		Select control of the DC brake via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

NB!
This parameter is active only when par. 8-01 Control *Site* is set to [0] *Digital and control word*.

8-53 Start Select

Option:		Function:
		Select control of the frequency converter start function via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	Activates Start command via a digital input.
[1]	Bus	Activates Start command via the serial communication port or fieldbus option.
[2]	Logic AND	Activates Start command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates Start command via the fieldbus/serial communication port OR via one of the digital inputs.

NB!
This parameter is active only when par. 8-01 Control *Site* is set to [0] *Digital and control word*.

8-54 Reversing Select

Option:		Function:
[0]	Digital input	Select control of the frequency converter reverse function via the terminals (digital input) and/or via the fieldbus.
[1]	Bus	Activates the Reverse command via the serial communication port or fieldbus option.

[2]	Logic AND	Activates the Reverse command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates the Reverse command via the fieldbus/serial communication port OR via one of the digital inputs.

NB!
This parameter is only active when par. 8-01 Control *Site* is set to [0] *Digital and control word*.

8-55 Set-up Select

Option:		Function:
		Select control of the frequency converter set-up selection via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	Activates the set-up selection via a digital input.
[1]	Bus	Activates the set-up selection via the serial communication port or fieldbus option.
[2]	Logic AND	Activates the set-up selection via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activate the set-up selection via the fieldbus/serial communication port OR via one of the digital inputs.

NB!
This parameter is active only when par. 8-01 Control *Site* is set to [0] *Digital and control word*.

8-56 Preset Reference Select

Option:		Function:
		Select control of the frequency converter Preset Reference selection via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	Activates Preset Reference selection via a digital input.
[1]	Bus	Activates Preset Reference selection via the serial communication port or fieldbus option.
[2]	Logic AND	Activates Preset Reference selection via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates the Preset Reference selection via the fieldbus/serial communication port OR via one of the digital inputs.

NB!
This parameter is active only when par. 8-01 Control *Site* is set to [0] *Digital and control word*.

8-90 Bus Jog 1 Speed

Range:		Function:
100 RPM*	[0 - par. 4-13 RPM]	Enter the jog speed. This is a fixed jog speed activated via the serial port or fieldbus option.

8-90 Bus Jog 1 Speed

Range:		Function:
100 RPM*	[0 - par. 4-13 RPM]	Enter the jog speed. This is a fixed jog speed activated via the serial port or fieldbus option.

8-91 Bus Jog 2 Speed

Range:	Function:
200 RPM* [0 - par. 4-13 RPM]	Enter the jog speed. This is a fixed jog speed activated via the serial port or fieldbus option.

8-91 Bus Jog 2 Speed

Range:	Function:
200 RPM* [0 - par. 4-13 RPM]	Enter the jog speed. This is a fixed jog speed activated via the serial port or fieldbus option.

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
8-0* General Settings						
8-01	Control Site	[0] Digital and ctrl.word	All set-ups	TRUE	-	Uint8
8-02	Control Word Source	null	All set-ups	TRUE	-	Uint8
8-03	Control Word Timeout Time	1.0 s	1 set-up	TRUE	-1	Uint32
8-04	Control Word Timeout Function	[0] Off	1 set-up	TRUE	-	Uint8
8-05	End-of-Timeout Function	[1] Resume set-up	1 set-up	TRUE	-	Uint8
8-06	Reset Control Word Timeout	[0] Do not reset	All set-ups	TRUE	-	Uint8
8-07	Diagnosis Trigger	[0] Disable	2 set-ups	TRUE	-	Uint8
8-1* Ctrl. Word Settings						
8-10	Control Word Profile	[0] FC profile	All set-ups	TRUE	-	Uint8
8-13	Configurable Status Word STW	[1] Profile Default	All set-ups	TRUE	-	Uint8
8-3* FC Port Settings						
8-30	Protocol	[0] FC	1 set-up	TRUE	-	Uint8
8-31	Address	1 N/A	1 set-up	TRUE	0	Uint8
8-32	FC Port Baud Rate	[2] 9600 Baud	1 set-up	TRUE	-	Uint8
8-35	Minimum Response Delay	10 ms	1 set-up	TRUE	-3	Uint16
8-36	Max Response Delay	5000 ms	1 set-up	TRUE	-3	Uint16
8-37	Max Inter-Char Delay	25 ms	1 set-up	TRUE	-3	Uint16
8-4* FC MC protocol set						
8-40	Telegram selection	[1] Standard telegram 1	2 set-ups	TRUE	-	Uint8
8-5* Digital/Bus						
8-50	Coasting Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-51	Quick Stop Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-52	DC Brake Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-53	Start Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-54	Reversing Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-55	Set-up Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-56	Preset Reference Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-9* Bus Jog						
8-90	Bus Jog 1 Speed	100 RPM	All set-ups	TRUE	67	Uint16
8-91	Bus Jog 2 Speed	200 RPM	All set-ups	TRUE	67	Uint16

7.3. Data Types Supported by FC 300

7.3.1. Object and Data Types Supported by FC 300

Data types supported by FC 300

Data type	Description
3	Integer 16
4	Integer 32
5	Unsigned 8
6	Unsigned 16
7	Unsigned 32
9	Visible string
10	Byte string
33	Standardized value (16 bit)
35	Bit sequence
41	Byte
42	Word

7.3.2. Conversion Index

This number refers to a conversion figure used when writing or reading to parameters.

Conversion index	Conversion factor
100	1
67	1/60
6	1000000
5	100000
4	10000
3	1000
2	100
1	10
0	1
-1	0.1
-2	0.01
-3	0.001
-4	0.0001
-5	0.00001
-6	0.000001

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8. Troubleshooting

Alarm word and warning word are shown on the display in Hex format. If there is more than one warning or alarm, a sum of all warnings or alarms will be shown. Warning word and alarm word can be displayed in par. 16-90 and 16-92.

FC 300			
Bit (Hex)	Unit diag-nose bit	Alarm word (Par. 16-90)	Alarm no.
00000001	48	Brake check	28
00000002	49	Power card over tem-perature	29
00000004	50	Earth fault	14
00000008	51	Control card over tem-perature	65
00000010	52	Control word timeout	18
00000020	53	Over current	13
00000040	54	Torque limit	12
00000080	55	Motor thermistor over temp.	11
00000100	40	Motor ETR over temper-ature	10
00000200	41	Inverter overloaded	9
00000400	42	DC link under voltage	8
00000800	43	DC link over voltage	7
00001000	44	Short circuit	16
00002000	45	Inrush fault	33
00004000	46	Mains phase loss	4
00008000	47	AMA not OK	50
00010000	32	Live zero error	2
00020000	33	Internal fault	38
00040000	34	Brake resistor power limit	26
00080000	35	Motor phase U is missing	30
00100000	36	Motor phase V is missing	31
00200000	37	Motor phase W is miss-ing	32
00400000	38	Fieldbus comm. fault	34
00800000	39	24 V supply fault	47
01000000	24	Mains failure	36
02000000	25	1.8 V supply fault	48
04000000	26	Brake resistor short cir-cuit	25
08000000	27	Brake chopper fault	27
10000000	28	Option change	67
20000000	29	Drive initialisation	80
40000000	30	Safe stop	68
80000000	31	Mechanical brake low	63

FC 300			
Bit (Hex)	Unit diagnose bit	Warning word (Par. 16-92)	Alarm no.
00000001	112	Brake check	28
00000002	113	Power card over temperature	29
00000004	114	Earth fault	14
00000008	115	Control card over temperature	65
00000010	116	Control word timeout	18
00000020	117	Over current	13
00000040	118	Torque limit	12
00000080	119	Motor thermistor over temp.	11
00000100	104	Motor ETR over temperature	10
00000200	105	Inverter overloaded	9
00000400	106	DC link under voltage	8
00000800	107	DC link over voltage	7
00001000	108	DC link voltage low	6
00002000	109	DC link voltage high	5
00004000	110	Mains phase loss	4
00008000	111	No motor	3
00010000	96	Live zero error	2
00020000	97	10 V low	1
00040000	98	Brake resistor power limit	26
00080000	99	Brake resistor short circuit	25
00100000	100	Brake chopper fault	27
00200000	101	Speed limit	49
00400000	102	Fieldbus comm. fault	34
00800000	103	24 V supply fault	47
01000000	88	Mains failure	36
02000000	89	Current limit	59
04000000	90	Low temperature	66
08000000	91	Voltage limit	64
10000000	92	Encoder loss	61
20000000	93	Output frequency limit	62
40000000	94	Unused	-
80000000	95	Warning word 2 (ext. stat. word)	-

FC 300	
Bit (Hex)	Comm. option STW (Par. 16-94)
00000001	Ramping
00000002	AMA tuning
00000004	Start CW/CCW
00000008	Slow down
00000010	Catch up
00000020	Feedback high
00000040	Feedback low
00000080	Output current high
00000100	Output current low
00000200	Output frequency high
00000400	Output frequency low
00000800	Brake check OK
00001000	Braking max.
00002000	Braking
00004000	Out of speed range
00008000	OVC active
00010000	AC brake
00020000	KTY warm
00040000	Fans warm
00080000	Unused
00100000	Unused
00200000	Unused
00400000	Unused
00800000	Unused
01000000	Unused
02000000	Unused
04000000	Unused
08000000	Unused
10000000	Unused
20000000	Unused
40000000	Unused
80000000	Unused

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8.1.1. Warning and Alarm Messages

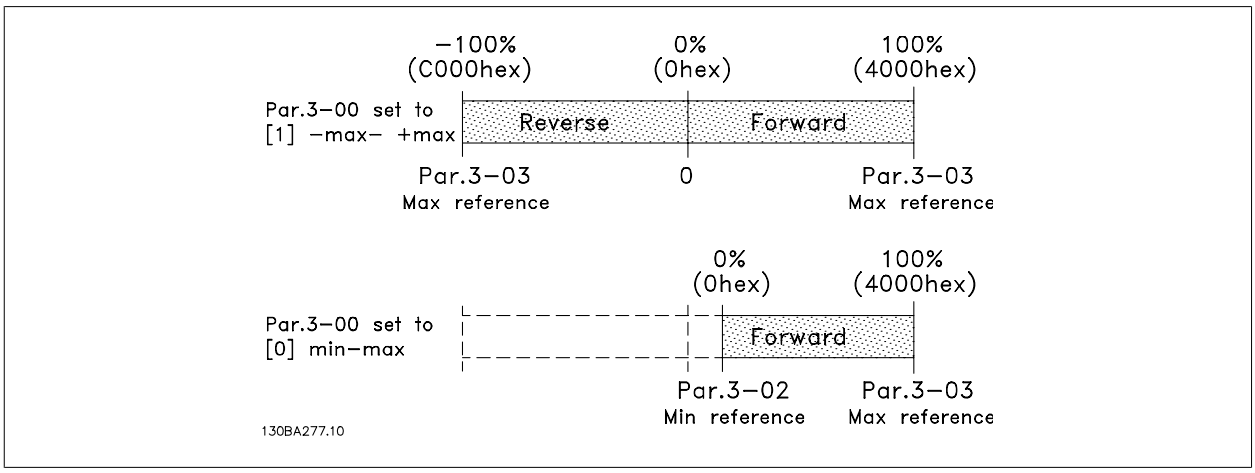
There is a clear distinction between alarms and warnings. When there is an alarm, the frequency converter will enter a fault condition. After the cause for the alarm has been cleared, the master will have to acknowledge the alarm message before the frequency converter can start operating again. A warning, on the other hand, may come when a warning condition appears, then disappear when conditions return to normal, without interfering with the process.

Warnings

Warnings within the frequency converter are represented by a single bit within a warning word. A warning word is always an active parameter. Bit status FALSE [0] means no warning, while bit status TRUE [1] means warning. Any bit change in the warning word will be notified by a change of bit 7 in the status word.

Alarms

Following an alarm message the frequency converter will enter Fault condition. Only after the fault has been alleviated and the master has acknowledged the alarm message by setting bit 7 in the control word, will the frequency converter resume operation. Alarms within the frequency converter are represented by a single bit within an alarm word. An alarm word is always an action parameter. Bit status FALSE [0] means no fault, while bit status TRUE [1] means fault.



Example 1:

Par. 3-00 = "-Max - +Max"

Par. 3-03 "Max reference" = 1500 RPM

Reference send = 1500hex (5376 dec)

The output can be calculated as:

$$\frac{Reference\,(decimal)}{16384} * par.\ 3-03 = \frac{5376}{16384} = 492\ RPM$$

Example 2:

Par. 3-00 = "Min - Max"

Par. 3-02 "Min reference" = 100 RPM

Par. 3-03 "Max reference" = 1500 RPM

Reference send = 1500hex (5376 dec)

The output can be calculated as:

$$\frac{Reference\,(decimal) * (par.3-03 - par.\ 3-02)}{16384} + par.\ 3-02 = \frac{5376 * (1500 - 100)}{16384} + 100 = 559\ RPM$$

8.2.1. LED Behaviour Stopped Interbus Comm.

In case of stopped Interbus communication, a particular behaviour of the "FC bus" –LED can be observed. The behaviour and conditions are as follows:

- Interbus communication is stopped by the Master
- The Interbus option is powered-up while the frequency converter is powered off
  - The "FC bus" LED is flashing, indicating baud-rate search
- The frequency converter is powered-up
  - The "FC bus" LED turns off, indicating baud-rate found and no FC-bus communication.

NB!

This might be interpreted as failing FC-bus communication, but in fact, the FC-bus comm. is inactive due to the stopped Interbus comm. This is not a failure.

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